Flexible regional references for administrative data

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Main sources for statistical information

Local administrative date are becoming more important

- registers

  local registers (with the **date** of validity or date of recording and **address**)
  - population register,
  - statistical registers of buildings and dwellings,
  - register of motor vehicles, …

  federal registers (with the **date** validity at the time of excerpt and **region**)
  - employed and unemployed persons,
  - recipients of social benefits, …

- sample surveys (with the reference **date** and **address** or statistical **region**)

- census (with the reference **date** and address or statistical **region**)

  frequently as a combination of register date and sample surveys

<= content data with time reference and regional reference
=> regional reference as a corner pillar in statistic

a) content reference

- survey, register and other administrative data
  (absolute / relative, qualitative / quantitative data)
- <= indicator, ratio, simulation, forecast

b) regional reference

- addresses (persons, locations)
- streets (addresses, borderline, type)
- regions (structure, administrative unit)
- geometry (spatial analyses, maps)
- dimension (distances, areas, proportions)
- <= collection, aggregation, visualisation

c) time reference

- historical, actual or future date
- <= collecting, time series, forecasts

<= content data and spatial references are changing in time!
Typical problems using regional references

Local planning needs local data

- **Regional analyses** refer to territorial structures.
  (administrative or planning units; e.g. zip code areas, school or election districts)

- Regional references of available content data usually **differ** from the geographical target structures of the analyses.
  (e.g. address references with zip code but not with school district - or future units)

- Territorial structures are **changing in time**.
  (e.g. new housing areas or a new school causes new school districts)

- Regional references of the content data need to be verified and **translated** into the target structures of the analyses.
  (e.g. address into zip code, school district – or “old” content data to “new” units)

- **Typical questions** to be answered:
  - localisation, distribution, densities (e.g. of students)
  - spatial clustering, dispersion (e.g. of handicapped, demand, traffic noise)
  - territorial accessibility, regional optimisation of supply and demand
    (e.g. distance to school, accessibility of bus stops)

<= in each case also changes over time are to be considered!
Basic elements of the alphanumerical code

The 3 basic elements of the standard regional reference system:
- streets (lookup table with keys and names of the streets)
- postal addresses (street, house number and appendix)
- sides of a block (section of a street).

From structure to code

1: 0 region of the city
2: 01 district
3: 010 town quarter
4: 010100 block neighbourhood with sides of the block
5: 0101001 to 0101004 with the sections of streets and the addresses
   <= up to 10 digits

Relations between these elements:
- any street has 0-n addresses and is in 1-n sides of 1-n blocks
- each address is associated to 1 street and is part of 1 side of 1 block
- every side of a block belongs to 1 street with 0-n addresses
Additional elements of the regional reference system

It can be used to identify, associate and aggregate any statistical regions, like building blocks, sub-city district and administrative units, like constituencies, postal code areas, school districts …

In combination with geometry any information can automatically be mapped or evaluated geographical information system (GIS).

=> Flexible regional reference system for actual and historical data!
=> Elements of a flexible regional reference system

- **Addresses** for referencing locations and collecting data
  (ca. 1% of the addresses of a city are changing in one year
c. 10% of the inhabitants are moving in one year!)

- **Stable territorial units** in the system of building-blocks
  for collecting and to associate data (belong to the addresses)
  (<0.1% of the building-blocks are changing in one year)

- **Flexible hierarchical system** of the building-blocks to
  aggregate data (1-3 level above and 1-2 level below the block)
  (normally ~ 1 modification in one year!)

- **Tessellation** of the hierarchical elements
  to define new territorial units (regions)
  (normally <1 modification in one year, decentralized at the responsible authority)

- **Linkage of these elements to geometry for visualisation & analyses**

- **Central maintenance system** for these elements
  with the possibility of shared processing (multi-user system)
Managing requirements for geographical references

- **Maintenance** (postal addresses, territorial codes and geometry)
- References between different territorial structures
- Reference date or beginning and end of validity (time reference) for geographical references and content data
- Relationships of historical references, codes and geometries to actual references
- Validity checks: plausibility, consistency and integrity (in space & time)
- Link between content data and geographical data (and tools)
- Tools for spatial and statistical analysis and presentation
Instruments to administrate the regional references

The alphanumerical coding system based on a DBMS
- to **administrate** the sub-city level structure of the city
- to **associate** data
- to **aggregate** the data to any statistical region.

The geographical information system (GIS)
- **combines the** alphanumerical with geometrical (vector) database
- **visualises** themes as layers

=> modular application for
- **the basic functions**
- **with consistent interrelations**
  - between the elements in space and time
- **in a relational DBMS**
Structure of AGK – applications for maintaining the standardised geographical reference system

GIS Interface

Graphical User Interface

DBMS
Standard geographical reference system AGK

Central management and hierarchical alphanumerical coding system: allocation of content data independent of origin for any record date and any site from the address to the side of the building block to a region:
Flexible regional references for administrative data, Andreas Gleich, City of Augsburg (Germany)

No.20: Geographic information system and regional reference system

... as a flexible, dynamic and consistence system

... with spatial integrity and consistency in time

... dynamical interaction between code and geometry systems

... for flexible code definitions

from the address to the side of the building block to a region:
Characteristics of regional reference on the sub-city level

Alphanumeric coding system with 3 basic elements
- streets (lookup table with keys and names of the streets)
- addresses (street, house number and appendix)
- sides of a block (section of a street).

Hierarchical code to identify, associate and aggregate
- the sides of the building blocks to the building block
- the building blocks to sub-city districts
- and so on up to 1-3 hierarchical levels above the block
- and any desired statistical region.

Covering the total area of the city based on the structure
- a hierarchical code can be assigned to all data
- any new address and the data which are related to it can be located in any sub-city level.

<= flexible regional reference system for actual and historical data
Central position of the regional reference system

structure
roads, rivers, topography

locations
schools, polling stations

alphanumeric code system
identification and relation of streets, addresses and sides of a block, statistical regions

graphology
- topological net with nodes, lines and polygons and attributes on it

results
tables, charts, maps representing the structure

statistical data registers, surveys
Thank you for your Attention!
KOSIS-Project AGK

Cooperation founded in 2001 for maintenance and development of more than 40 German municipalities in the KOSIS-Network for utilisation, implementation and maintenance of computer based instruments within the association of the German municipal statisticians (VDSt)

Since 4 Years field-tested in cities
- with 100 - 600 thousands inhabitants each (scalable to millions), altogether more than 7 millions
- with different kinds of hierarchical structure
- with or without geometry
  and also in regions with > 20 smaller cities

<= standardized geographical reference system
(based on recommendations of the Statistics Committee of the Union of German Municipalities of 1967, 1976 and 1991)
Basic tasks and functions

- define, describe, manage, update and analyse the data of the streets, addresses, buildings, hierarchical structure and regions and its relationships and history

- **WITH historical recording**
  - **new** (incl. blocking, proposal, …)
  - **processing** (modifications, predecessor, termination)
  - **re-assignment** (of a terminated element, e.g. of an address)
  - **split** (e.g. street, building, BLS, …)
  - **rename / move** (e.g. name of a street, BLS, …)
  - **join** (e.g. name of a street, BLS, …)

- **WITHOUT historical recording**
  - **correction** (e.g. typing errors, …)
  - **deleting** (e.g. incorrect datasets, …)

- **Operations**: plausibility check, linkage in space and time, status, date
Relations between the elements (simplified data model)

- City
- Polygon
- Line
- Node
- Street
- Address
- Building
- Hierarchy (block and higher)
- Statistical region

Relation:
- 1:1
- 1:2
- 1:n
- n:m

Module:
- ADZ
- KG
- Geometry
- Buildings
Perspectives ...

Alphanumerical system

- Automation of the communication between the Interfaces e.g. interactive WWW-Application, ...
- Description of the workflow for typical Questions
- Extension for integration of grid cells in the System
- Translation into foreign languages (on demand)

Geometry

- Automation thematic cartography (content data interface)
- Integration of routing functionality
- Integration of external databases (WMS, Google, …)

... and international cooperation
Content of the presentation

- The meaning of regional reference
- The basic elements of the sub-city references
- The instrument of German municipalities
- Demands
- Perspectives